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In re Patent Application of

J. GEORG BEDNORZ and
K. ALEX MUELLER

Serial No.: 07/053,307

Filed: 22 May 1987

Art Unit: 115

Examiner: John Boyd

For: NEW SUPERCONDUCTIVE COMPOUNDS
HAVING HIGH TRANSITION
TEMPERATURE, AND METHODS FOR
THEIR USE AND PREPARATION

INFORMATION DISCLOSURE STATEMENT UNDER 37 CFR 1.97

Honorable Commissioner of Patents
and Trademarks
Washington, D.C. 20231

Sir:

Pursuant to 37 CFR 1.97, the attorneys for the applicants submit the following statement.

The attorneys for the applicants hereby bring to the attention of the United States Patent and Trademark Office the following publications and unpublished manuscripts which are broadly related to the field of the instant invention:

Publications and Unpublished Manuscripts

J. B. Goodenough and J. M. Longo, *Magnetic and Other Properties of Oxides and Related Compounds*, in Landolt-Bornstein New Series, vol III/4a, K.-H. Hellwege and A. M. Hellwege, eds. (Springer-Verlag 1970), pages 261-314;

P. W. Anderson, *Comments on Solid State Physics*, vol. II, pages 193-197, (February/March 1970);

R. Englman, *The Jahn-Teller Effect in Molecules and Crystals*, (Wiley-Interscience, 1972), pages 139-141, 164-181, 249-265;

B. K. Chakraverty, *Journal de Physique-Lettres*, vol. 40, pages L-99 - L-100, (March 1979);

G. Deutscher et al., *Physical Review B*, vol. 21, pages 5041-5047, (1 June 1980);

K. A. Muller et al., *Physical Review Letters*, vol. 45, pages 832-835, (8 September 1980);

R. A. Buhrman et al., in *AIP Conference Proceedings, Inhomogeneous Superconductors - 1979*, (Berkeley Springs, W. V.), D. U. Gubser et al., pages 207-215 (1980);

T. D. Thanh et al., *Applied Physics*, vol. 22, pages 205-212 (1980);

C. Methfessel and S. Methfessel, in *Proceedings of the IV Conference on Superconductivity in d- and f- Band Metals*, W. Buckel and W. Weber, eds. Kernforschungszentrum, Karlsruhe, 1982), pages 393-399;

A. Baratoff et al., in *Proceedings of the IV Conference on Superconductivity in d- and f- Band Metals*, W. Buckel and W. Weber, eds. Kernforschungszentrum, Karlsruhe, 1982), page 419;

J. Muller, *Rep. Prog. Phys.*, vol. 43, pages 642-687, (1980);

M. Suzuki et al., *Shinku*, vol. 24 pages 67-75, (1981), [in Japanese];

K. A. Muller et al., *Physical Review Letters*, vol. 47, pages 138-142, (13 July 1981);

Y. Enomoto et al., *Japanese Journal of Applied Physics*, vol. 20, pages L661-L664, (September 1981);

B. K. Chakraverty, *Journal de Physique* vol. 42, pages 1351-1356, (September 1981);

L. Er-Rakho et al., *Journal of Solid State Chemistry*, vol. 37, pages 151-156, (1981);

A. Baratoff and G. Binnig, *Physica*, vol. 108B, pages 1335-1336, (1981);

L. F. Mattheiss and D. R. Hamann, *Physical Review B*, vol. 26, pages 2686-2689, (1 September 1982);

L. F. Mattheiss and D. R. Hamann, *Physical Review B*, vol. 28, pages 4227-4241, (15 October 1983);

- K.-H. Hock et al., *Helvetica Physica Acta*, vol. 56, pages 237-243, (1983);
- N. Nguyen et al., *Journal of the Physics and Chemistry of Solids* vol. 44, pages 389-400, (1983);
- D. R. Bowman and D. Stroud, *Physical Review Letters*, vol 52, pages 299-302, (23 January 1984);
- M. Tinkham et al., *Workshop on Problems in Superconductivity*, Copper Mountain, CO, pages 12-22, (1984);
- B. Batlogg, *Physica*, vol. 126B, pages 275-279, (1984);
- C. Ebner and D. Stroud, *Physical Review B*, vol. 31, pages 165-171, (1 January 1985);
- M. R. Harrison et al., *Philosophical Magazine B*, vol. 52, pages 679-699, (1985);
- E. Stocker and J. Buttet, *Solid State Communications*, vol. 53, pages 915-917, (1985);
- C. Van Haesendonck and Y. Bruynseraede, *Physical Review B*, vol. 33, pages 1684-1690, (1 February 1986);
- H. R. Ott, *Unconventional Superconductivity*, Zurich Physical Society Seminar, Zurich, (13 February 1986), [in German];
- T. Ogushi and Y. Osono, *Applied Physics Letters*, vol. 48, pages 1167-1168, (28 April 1986);
- S.-I. Uchida et al., "High T_c Superconductivity of La-Ba-Cu Oxides" unpublished nine-page manuscript bearing date of 22 November 1986;
- Asahi Shinbun*, International Satellite Edition (London), 28 November 1986, (in Japanese with English translation);
- H. Takagi et al., "High- T_c Superconductivity of La-Ba-Cu Oxides. II-Specification of the Superconducting Phase", unpublished nine-page manuscript bearing date of 8 December 1986;
- S.-I. Uchida et al., "High- T_c Superconductivity of La-Ba-Cu Oxides. III-Electrical Resistivity Measurement" unpublished nine-page manuscript (page 7 missing) bearing date of 22 December 1986;
- K. Kishio et al., "New High temperature Superconducting Oxides. $(La_{1-x}Sr_x)_2CuO_{4-\delta}$ and $(La_{1-x}Ca_x)_2Cu_{4-\delta}$ " unpublished four-page manuscript bearing date of 22 December 1986;

C. W. Chu et al., "Superconductivity Above 52K in the La-Ba-Cu-O System" unpublished fourteen-page manuscript bearing date of 30 December 1986;

W. Sullivan, *New York Times*, 31 December 1986, page A1, cols. 2-3 and A13, cols. 1-2;

S.-I. Uchida et al., "High- T_c Superconductivity of La-Ba(Sr)-Cu Oxides. IV - Critical Magnetic Fields" unpublished ten-page manuscript bearing date of 8 January 1987;

S. Kanbe et al., "Superconductivity and Lattice Parameters in $(La_{1-x}Sr_x)_2CuO_{4-\delta}$ Solid Solution System" unpublished four-page manuscript bearing date of 13 January 1987;

H. Takagi et al., "Influence of the Oxygen Deficiency on the Electrical Resistivity in High- T_c Superconducting Oxides $(LaBa)_2CuO_{4-y}$ " unpublished eight-page manuscript bearing date of January 1987; and

Z. Zhao et al., "High T_c Superconductivity of Sr(Ba)La-Cu Oxides" unpublished eleven-page manuscript bearing date of 21 January 1987.

The publications and unpublished manuscripts identified above are listed on form PTO 1449 which accompanies this statement. Copies of the publications and unpublished manuscripts are being submitted with this statement.

The attorneys for the applicants take no position on whether or not any particular document cited in the present Disclosure Statement and listed on form PTO 1449 constitutes prior art relative to the subject invention with respect to some particular provision of Title 35 of the United States Code. As discussed in detail below, for example, it is the position of the attorneys that a number of the documents identified above bearing dates of less than a year before the filing date of the subject application to the extent they include material which might otherwise appear to be relevant to the invention of the application are essentially only describing the work of the applicants in the

subject application and so do not constitute prior art against the application under United States law.

The two publications discussed briefly in the following two paragraphs concerned certain families of lanthanum copper oxide compounds.

The publication by Er-Rakho et al. in Journal of Solid State Chemistry, volume 37, pages 151-156 (1981), concerned a series of defect perovskites having the general formula $\text{La}_{3-x}\text{Ln}_x\text{Ba}_3\text{Cu}_6\text{O}_{14+y}$, where Ln = Y, Pr, Nd, Sm, Eu, Gd, Er, and Yb. In the case of $\text{La}_3\text{Ba}_3\text{Cu}_6\text{O}_{14+y}$, the value of y reportedly varied with oxygen pressure to which the compound was exposed during an anneal at 400°C.

According to an English-language abstract, the publication by N. Nguyen et al. in the Journal of the Physics and Chemistry of Solids, volume 44, pages 389-400 (1983), concerned the magnetic and electron transport properties of certain mixed valence copper oxides having the general formula $\text{La}_{2-x}\text{Sr}_x\text{CuO}_{4-x/2+\delta}$, where $0 \leq x \leq 1.20$. The publication is in French and the attorneys for the applicants do not have an English translation. Table 1 on page 390 appears to give the unit cell dimensions for the compound with various specific values for x and 2δ . According to the abstract, a progressive evolution of the conductivity from a semiconductor to a semimetallic behavior was observed as the amount of copper in the trivalent state increased.

In response to a request in section 24 of the Office Action of 8 August 1990 for the subject application regarding so-called "preprints," the nine unpublished manuscripts identified below have been located which bear on their face

dates in advance of the priority date to which the subject application is entitled:

AUTHORS

DATE FROM FACE OF MANUSCRIPT

1) S.-I. Uchida et al.	22 November 1986
2) H. Takagi et al.	8 December 1986
3) S.-I. Uchida et al.	22 December 1986
4) K. Kishio et al.	22 December 1986
5) C. W. Chu et al.	30 December 1986
6) S.-I. Uchida et al.	8 January 1987
7) S. Kanbe et al.	13 January 1987
8) H. Takagi et al.	17 January 1987
9) Z. Zhao et al.	21 January 1987.

An electronic-mail note dated 17 December 1986 from Dr. Richard Greene of IBM to the applicants suggests that the unpublished manuscripts bearing the dates 22 November and 8 December were in the hands of Dr. Greene on 16 December 1986. A copy of a printout of the note of 17 December 1986 is attached as Appendix A.

An electronic-mail note dated 7 January 1987 from Dr. Paul Grant of IBM to the applicants and Dr. Greene described a meeting of an Applied Physics Journal Club at Stanford University held on the day of the note. A copy of a printout of the 7 January 1987 note is attached as Appendix B. Reference was made to a "Bell preprint" and to two preprints of Chu. Reference was also made to an article in the New York Times and to an article in the Biejing People's Daily of mid-December.

A copy of an unpublished manuscript by Chu et al. bearing the date 30 December 1986 is submitted with this statement. The attorneys for the applicants do not have copies of any unpublished manuscript which might correspond to a second "preprint" of Chu or to the "Bell preprint" referred to in the note of 7 January 1987. A copy of an article in the New York Times edition of 31 December 1986 concerning superconductivity is submitted with this statement. The attorneys for the applicants do not have a copy of the article in the Beijing People's Daily referred to in the note of 7 January 1987.

Each of the nine unpublished manuscripts identified above expressly attributes the discovery of superconductivity in copper oxide materials to the present applicants. For example, the unpublished manuscript by Uchida et al. bearing the date 22 November 1986 stated on page 1, line 21 through page 2, line 3 as follows:

Another candidate [superconducting material] is La-Ba-Cu oxide. This material has been investigated extensively by Michel and his coworkers. Quite recently Bednorz and Muller have reported that the Ba-La-Cu-O system with the composition $\text{Ba}_x\text{La}_{5-x}\text{Cu}_5\text{O}_{5(3-x)}$ is a potential material as the third high-Tc oxide. The resistivity measurement on the polycrystalline samples showed that the sample prepared in a certain condition is superconducting below 13K. The most interesting fact is that the resistivity starts to decrease at 30K with lowering temperature. They suggested that this might correspond to an onset of superconductivity in a part of the sample.
[References omitted]

The reference to Bednorz and Muller in the quotation above was accompanied by a citation to the article by the applicants in Zeitschrift fur Physik B-Condensed Matter, Vol. 64, pages 189-193 (September 1986) ("the Bednorz and Muller publication") which is of record in the subject application.

See also the unpublished manuscripts by Takagi et al. bearing the date 8 December 1986 at page 2, lines 1-4 and reference 2; Uchida et al. bearing the date 22 December 1986 at page 2, lines 5-10; Kishio et al. bearing [on the last page] the date 22 December 1986 at page 1, lines 18-21 and references 2 and 3; Chu et al. bearing the date 30 December 1986 at page 3, lines 13-25 and reference 1; Uchida et al. bearing the date 8 January 1987 at page 2, lines 1-3 and reference 1 [evidently a preprint of an article by the applicants and a coworker which appeared in Europhysics Letters , volume 3, pages 379-389 (1987) which in turn refers to the Zeitschrift fur Physik article of the applicants]; Kanbe et al. bearing the date 13 January 1987 at page 1, lines 13-14 and references 1 and 2; Takagi et al. bearing the date 17 January 1987 at page 2, lines 1-6 and reference 1; and Zhao et al. bearing the date 21 January 1987 at page 1, lines 12-14 and reference 1.

Thus, such disclosed in each of the manuscripts identified above as might otherwise appear to be relevant to the invention of the subject application is in fact the work of the applicants Drs. Bednorz and Mueller or derived from the prior work of the applicants, as acknowledged in the manuscripts themselves. As a result, none of the unpublished manuscripts constitutes prior art against the subject application irrespective of whether or not any of the manuscripts might constitute a publication under United States patent law and irrespective of the date the invention was reduced to practice in the United States by or on behalf

of the applicants. The Court of Appeals for the Federal Circuit has held that

Rule 131 ... is only one way of overcoming a reference that is not a statutory bar. An applicant may also overcome a reference by showing that the relevant disclosure is a description of the applicant's own work. [Citations omitted.]

In re Costello and McClean, 219 USPQ 389,391 (Fed. Cir. 1983).

The article in the 28 November 1986 edition of Asahi Shinbun noted that the "possibility of high Tc-superconductivity has been reported by scientists in Switzerland in this spring" and went on to report that Professor Shoji Tanaka had "confirmed" that an oxide of La and Cu with Ba exhibited the Meissner effect, an indication of superconductivity, up to 30K. The article in the 31 December 1986 edition of the New York Times after referring to developments reported by researchers at the University of Houston and A.T. & T. Bell Laboratories, noted that

These developments follow a discovery reported last April by researchers at the I.B.M. Zurich Research Laboratory in Switzerland. Using a combination of copper, oxygen, barium and lanthanum, they achieved superconductivity at 30 degrees Kelvin, opening a new line of attack on the problem.

Later in the article, the I.B.M. findings were attributed to an article by J. G. Bednorz and K. A. Mueller in Zeitschrift fur Physik, Series B. (Contrary to the implication in the New York Times and Asahi Shudron articles, the first publication by Drs. Bednorz and Mueller concerning high Tc superconductivity did not appear in April 1986 or otherwise in the spring of 1986, but appeared in September 1986 with the publication of their Zeitschrift fur Physik B article cited above.) Neither the Asahi Shinbun nor the New York Times article constitutes prior art against the present application since - as evident from the articles themselves

- such as otherwise might appear to be relevant to the subject application was derived from the prior invention of the applicants. Under the doctrine of the Costello and McLean case cited in the preceding paragraph, the articles do not constitute references against the subject application.

The remaining publications identified above were cited either in the Bednorz and Mueller publication or in a publication by Bednorz, Mueller and M. Takashige, in Europhysics Letters, volume 3, pages 379-385 (1987), both of which publications are of record in the subject application. The publications are included in the present Information Disclosure Statement for completeness.

Submitted with this Information Disclosure Statement is a Claim to Priority Under 35 U.S.C. Section 119 for the application. The priority claim is based on European application Serial No. 87100961.9, filed 23 January 1987 ("the European '961 application"). The European '961 application identified as joint inventors Dr. Bednorz and Dr. Mueller - the applicants in the subject United States application - and Masaaki Takashige, a Japanese citizen residing in Ruschlikon, Switzerland at the time of filing the European application. The difference in inventorship between the subject United States application and the European '961 application arose under the circumstances of the present case because patent laws of the United States and the European patent convention differ, as discussed in the following paragraph.

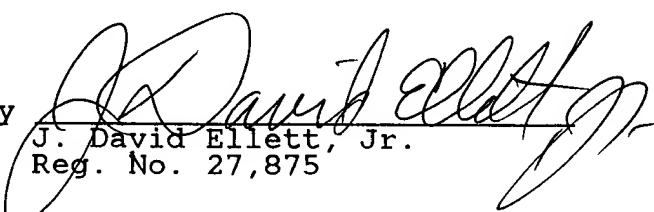
The European patent convention has generally an "absolute novelty" standard of patentability with regard to divulgation of an invention in a publication by the

inventors, whereas United States patent law provides a one-year grace period for filing a patent application following the first description of an invention by the inventors in a publication. In the present case, basic aspects of the invention were described in an article by Drs. Bednorz and Mueller in Zeitschrift fur Physik B-Condensed Matter, Volume 64, pages 189-193 which, as noted above, was published in September 1986. Since the Bednorz and Mueller publication appeared before the '961 European application was filed, aspects of the invention described in the publication were ineligible for patent protection in the European application under the European "absolute novelty" patentability standard. The '961 European application therefore included other material in addition to that described in the Bednorz and Mueller article in support of patentability under the European patent law. In accordance with standard European patent practice, Drs. Bednorz, Mueller and Takashige were designated joint inventors of the subject matter for which patent protection was sought under the European patent convention in the '961 European patent application. In the case of the subject United States application, basic aspects of the invention described in the Bednorz and Mueller publication were not ineligible for patent protection by virtue of the one-year grace period provided by United States patent law. The subject United States application is intended to secure patent protection for fundamental aspects of the invention for which Drs. Bednorz and Mueller are jointly the inventors under principles of United States patent law. A United States patent application may secure the benefit of priority under the International Convention of a foreign patent application having a different inventive entity if the foreign application was regularly filed and the designation of

inventorship in the United States application is correct.
Payne v. Natta, Pino and Mazzanti, 172 U.S.P.Q. 687, 693
(Pat. Off. Bd. of Pat. Inter. 1971).

Respectfully submitted,
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by


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